

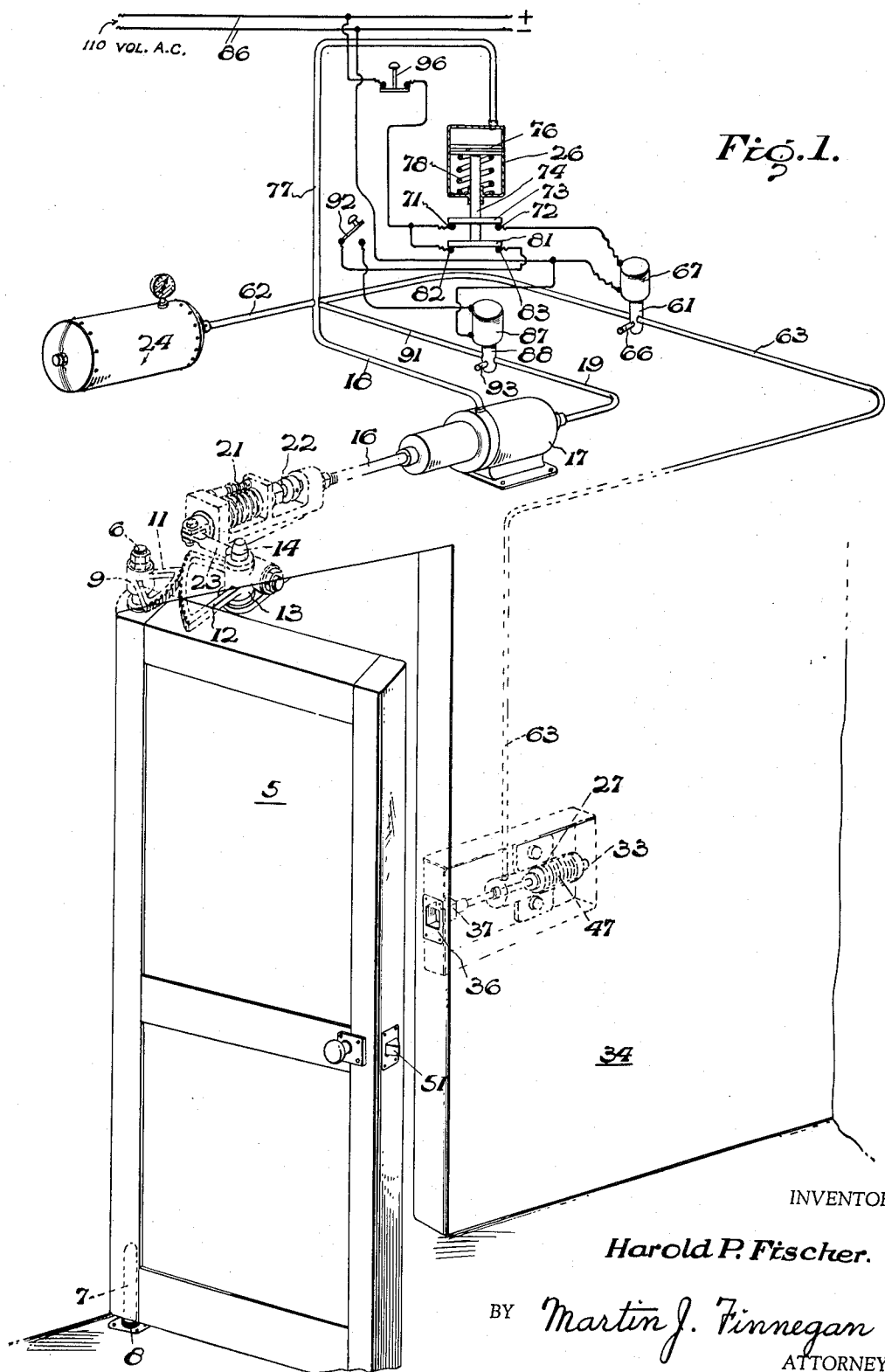
Feb. 7, 1956

H. P. FISCHER
FIRE DOOR CONTROL

2,733,918

Filed Dec. 27, 1950

2 Sheets-Sheet 1



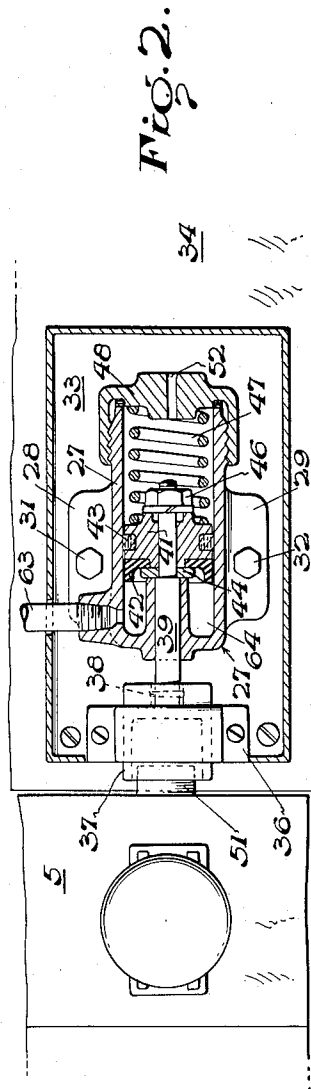
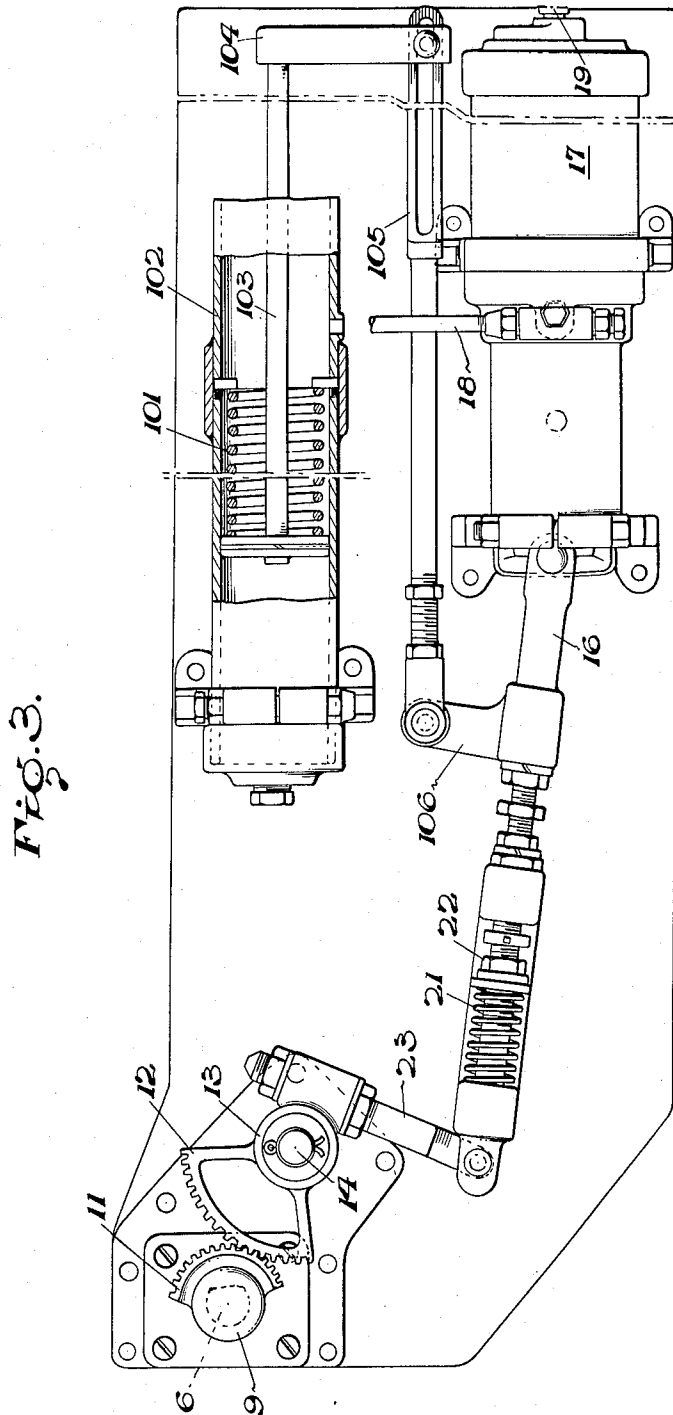
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2 Sheets-Sheet 2



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FIRE DOOR CONTROL

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21 Claims. (Cl. 268—66)

This invention relates to fire doors, and particularly to the control of the opening, closing, locking, and unlocking of fire doors.

In locations where a fire hazard exists, it is desirable to confine a fire to one of several compartments or chambers. For this purpose, particularly in the construction of ships, it is customary to employ fire-proof doors to control access between adjoining compartments, with means for closing such doors automatically when a fire occurs in one of said two adjoining compartments; but there is difficulty in maintaining the door closed, or locked in the closed position, against all efforts of unauthorized persons to unlock or open it. If resort is had to an automatic lock of ordinary construction, such an arrangement has the disadvantage that it tends to interrupt normal use of the door in times other than emergencies.

The present invention affords a solution whereby the advantages of automatic locking may be enjoyed in an emergency, yet during normal periods there is no tendency for the door to lock itself in the closed position.

An object of the invention, accordingly, is to provide automatic lock-control for fire doors, with supervisor-controlled means for rendering the lock inapplicable except during emergencies.

A second object is to provide a control system for fire doors—but applicable also to any door where comparable control is desired—operative to cause the door to move to closed position automatically after each opening thereof, and to remain locked or unlocked in said closed position, according to the decision of the supervisor; as registered through the instrumentality of his control element.

A third object is to provide, in such a system, means responsive to the emergency itself for automatically locking the door in its closed position, independently of any supervisory action; such automatic locking being effective whenever power failure (of either an electric or fluid pressure nature) occurs.

Other objects and features of the invention will be apparent upon examination of the following description of the embodiment illustrated in the accompanying drawings wherein Fig. 1 is a view in perspective of a door and door frame having the invention applied thereto; Fig. 2 is a longitudinal sectional view of the door lock controlling elements of the system; and Fig. 3 is a top plan view of the mechanism for swinging the door between its two extreme positions; the parts as shown in Fig. 3 being in their "door-closed" relationship.

In Fig. 1 the door 5 is illustrated as being mounted upon a pair of vertically extending shafts 6 and 7, the latter being located near the bottom edge of the door and terminating in a socket 8 attached to the floor of a building (or deck of a ship) and the shaft 6 being located near the upper edge of the door and provided with a sleeve portion 9 integral with or keyed thereto;

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the said sleeve 9 also including an extending portion 11 of sector shape with its outer arcuate surface formed into a series of gear teeth adapted to mesh with correspondingly formed teeth on a similar sector element 12 having a central circular boss 13 adapted to turn about a stationary post 14 (see Fig. 3) in response to reciprocation of a rod 16 attached to a piston of differential dimensions adapted to operate within the compound cylinder 17 to which are connected pressure fluid receiving conduits 18 and 19; there being resilient and adjustable connections 21 and 22 interposed between the piston rod 16 and a link 23 pivotally connecting the piston rod assembly with the sector 12. A source of pressure fluid is indicated at 24, and in addition to the pressure fluid receiving cylinder 17 the system includes a switch operating fluid receiving cylinder 26 and a door lock controlling cylinder 27.

As shown in Fig. 2 the lock controlling cylinder 27 is in the form of a casting having flanges 28 and 29 through which pass bolts 31 and 32 for attachment of the casting to a mounting plate 33 which is in turn secured to the partition or wall indicated at 34 (Fig. 1), the edge face of which wall has mounted thereon a latch keeper housing 36 within which is slidable a hollow rectangular keeper block 37 to the rear portion of which is attached (as by a suitable cross pin 38) a piston rod 39 to whose opposite end is attached a piston assembly reciprocable within the above described cylinder 27; the same piston assembly including a main piston element 41, sealing elements 42 and 43, a cushioning ring 44 of compressible material and a nut 46 adjustably received on suitable threads provided on the reduced end portion of the piston rod. A coiled compression spring 47 has one end thereof in abutting contact with the exposed surface of the piston element 41 and its opposite end in contact with the central portion of a nut 48 the threads of which engage corresponding threads of cylinder 27 to constitute means for adjusting the degrees of pressure exerted upon the piston in the direction in which the slidable keeper 37 must move in order to embrace and thus restrain lateral movement of door latch 51 and thereby lock the door 5 against opening movement. The nut 48 is shown as having a central passageway 52. Any air contained in the cylinder 27 to the right of the piston 41 may pass freely therefrom thus preventing the pressure to the right of the piston from building up to any value above atmospheric.

The novel means for normally maintaining the piston 41 of the lock controlling assembly in a position somewhat to the right of the position illustrated in Fig. 2—and thereby maintaining the movable keeper 37 sufficiently to the right of the latch 51 to allow withdrawal of said latch from the keeper in response to opening pressure exerted upon the door either manually or by the power operated mechanism of Fig. 3—is shown in Fig. 1 as including an electro-magnetic valve 61 to receive pressure fluid from a source 24 by way of a conduit 62, and direct such fluid into a conduit 63 leading to the cylinder 27. In addition to the two ports in which the conduits 62 and 63 terminate, the valve 61 has a third port 66 opening to the atmosphere; but so long as electric current is supplied to the windings 67 of the valve the movable portion thereof is held in such position as to maintain communication between the conduit 62 and conduit 63, and closes off exhaust port 66. Upon any interruption of the current flow, however, the movable valve element is shifted (by spring pressure or otherwise) to a position in which the previously existing communication between the conduits 62 and 63 is cut off, and instead the conduit 63 is connected into communication with the exhaust port 66, thus allowing the pressure fluid within chamber 64 of the cylinder 27 to escape to atmosphere.

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phere, whereupon spring 47 becomes effective by way of the piston 41 and piston rod 39, to move the latch keeper 37 back into the position indicated in Fig. 2 in which position it restrains the latch 51 and thus prevents opening of the door.

The means for controlling flow of current to the winding 67 of the valve 61 includes a set of contacts 71 and 72 adapted to be bridged by a metallic element 73 attached to a rod 74 terminating in a piston 76 slidable within the cylinder 26 and constantly supplied with fluid under pressure from source 24 by way of connections 62 and 77; the said fluid under pressure serving to maintain the said switch 73 in closed position against the yielding opposition of a spring 78 located within the cylinder 26 below piston 76. Should for any reason there be a failure of pressure in source 24 (or in the connections 62 and 77) thereby allowing the fluid to exhaust from the cylinder 26, the spring 78 will immediately become effective to open the switch 73 and thus de-energize the winding 67, whereupon the valve 61 will move to the fluid exhaust position, thus relieving the pressure in the lock control cylinder 27 and allowing the spring 47 thereof to reset the latch keeper 37 in the door restraining position.

The switch operating element 74 also preferably includes a second bridging element 81 adapted to bring a set of contacts 82 and 83 to cause flow of current from source 86 to the windings 87 of a second valve 88 similar in construction to the valve 61 and adapted, whenever the coil 87 is energized, to exhaust fluid under pressure from one side of the piston within cylinder 17 by way of conduit 19 leading to the valve 88 and the exhaust port 93 emerging therefrom. In order to produce current flow it is necessary to close a second switch 92 which is in series with the switch 81 and is normally in an open position. During this normal condition there is no current flowing through the windings of solenoid 87, and therefore the cylinder 17 (or, rather, that portion thereof that lies to the right of the piston therein) is connected with pressure source 24 by way of conduits 62 and 91 and the valve 88. Accordingly, in the normal condition, the motor 17 is constantly exerting a pressure on the door 5 (through the linkage 16—12—11) to oppose manual opening thereof, even though keeper 36 is in the withdrawn position. On the other hand the chamber of cylinder 17 which lies to the left of the piston is at all times supplied with fluid under pressure from the source 24 by way of the connecting lines 62 and 18, and this pressure serves as the force to open the door 5 whenever the switch 92 is manually closed to exhaust fluid pressure from the right-hand chamber of cylinder 17 by way of valve 88 and conduit 19. Should there be a pressure failure in an adjacent line 18, spring 101 of auxiliary cylinder 102 (Fig. 3) operates to hold the door in closed position, by exerting pressure by way of links 103 to 106, inclusive, the latter connecting with rod 16.

The means whereby a supervisor at a central station may release the power normally applied to the cylinder 27 and thereby cause the latch keeper 37 to assume the locking position with respect to the door latch 51, under the influence of the spring 47, is shown as taking the form of a normally closed switch 96 inserted in the line in series with the switch contacts 71 and 72 (and also in series with the switch contacts 82 and 83) so that manual opening of said switch 96 causes an interruption of current to both the valves 61 and 88 and therefore permits both these valves to move to the fluid exhausting positions. The latch keeper 37 thereupon assumes the locking position, as above noted, and will remain in this locking position until fluid pressure is again applied to cylinder 27 by reason of the reclosing of manual switch 96 and the resulting energization of the winding 67 of the valve 61.

What I claim is:

1. In means for controlling passage between two ad-

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joining compartments comprising: a door mounted on the wall common to the two compartments, said door having a latching element mounted thereon, and a keeper assembly mounted in said wall and including a keeper element positioned in alignment with said latching element for cooperation therewith to retain the door in closed position; the improvement which comprises means biasing said keeper element into said cooperating position, fluid pressure-operated means operatively connected to said keeper element for maintaining the latter away from said cooperating position against the action of said biasing means, a source of fluid pressure connected to said fluid pressure-operated means via a valve means, and control means for said valve means sensitive to the pressure of said source and effective to move said valve means to inoperative position disconnecting said fluid pressure-operated means from said source when the pressure of said source falls below a predetermined value.

2. In the combination of claim 1, a fluid pressure-operated motor operatively connected to said door to open and close the latter, said motor being connected to said fluid pressure source, a control element operatively connected to said motor and capable of assuming a first condition such as to cause said motor to close said door and a second condition such as to cause said motor to open said door, said control means sensitive to the pressure of said source being operatively connected to said control element and effective to cause said element to assume its first condition when the pressure of said source falls below a predetermined value.

3. The combination of claim 2, in which a second and manual control means is operatively connected to said motor control element, said second control means being effective to fix the condition of said element only when the first control means therefor tends to cause said element to assume its second position.

4. In the combination of claim 1, a second and manual control means operatively connected to said valve means, said second control means being effective only when the first control means therefor tends to position said valve means so as to connect said source and said fluid pressure-operated means.

5. In the combination of claim 4, a fluid pressure-operated motor operatively connected to said door to open and close the latter, said motor being connected to said fluid pressure source, a control element operatively connected to said motor and capable of assuming a first condition such as to cause said motor to close said door and a second condition such as to cause said motor to open said door, said control means sensitive to the pressure of said source being operatively connected to said control element and effective to cause said element to assume its first condition when the pressure of said source falls below a predetermined value.

6. In the combination of claim 4, a fluid pressure-operated motor operatively connected to said door to open and close the latter, said motor being connected to said fluid pressure source, a control element operatively connected to said motor and capable of assuming a first condition such as to cause said motor to close said door and a second condition such as to cause said motor to open said door, said control means sensitive to the pressure of said source being operatively connected to said control element and effective to cause said element to assume its first condition when the pressure of said source falls below a predetermined value, and in which a second and manual control means is operatively connected to said motor control element, said second control means being effective to fix the condition of said element only when the first control means therefor tends to cause said element to assume its second position.

7. Means for controlling passage between two adjacent compartments comprising: a door mounted on the wall common to the two compartments, said door having a latching element mounted thereon, a keeper assembly

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mounted in said wall and including a keeper element positioned in alignment with said latching element for cooperation therewith to retain the door in closed position, means biasing said keeper element into said cooperating position, fluid pressure-operated means operative on said keeper element so as to withdraw it from said cooperating position against the action of said biasing means, a source of fluid pressure connected to said fluid pressure-operated means via a valve means, manually actuated control means located at a remote station and operatively connected to said valve means for positioning the latter to disconnect said source from said fluid pressure-operated means, a fluid pressure-operated motor operatively connected to said door so as to open and close the latter, said motor being connected to a source of fluid pressure, a control element operatively connected to said motor and capable of assuming a first condition such as to cause said motor to close said door and a second condition such as to cause said motor to open said door, and control means operatively connected to said element, sensitive to the pressure of said source and effective to cause said element to assume its first condition when the pressure of said source falls below a predetermined value.

8. The combination of claim 7, in which the control means for said motor control element and the control means for the fluid pressure-operated means active on said keeper are interlocked for simultaneous actuation.

9. The combination of claim 8, in which a second and manual control means is operatively connected to said motor control element, said second control means being effective to fix the condition of said element only when the first control means therefor tends to cause said element to assume its second position.

10. The combination of claim 7, in which a second and manual control means is operatively connected to said motor control element, said second control means being effective to fix the condition of said element only when the first control means therefor tends to cause said element to assume its second position.

11. In the combination of claim 7, resilient means active on said door so as to urge it to closed position.

12. In means for controlling passage between two adjoining compartments comprising: a door mounted on the wall common to the two compartments, said door having a latching element mounted thereon, and a keeper assembly mounted in said wall and including a keeper element positioned in alignment with said latching element for cooperation therewith to retain the door in closed position; the improvement which comprises means biasing said keeper element into cooperating position, fluid pressure-operated means operatively connected to said keeper element for maintaining the latter away from said cooperating position against the action of said biasing means, a source of fluid pressure connected to said fluid pressure-operated means via an electrically energized valve means connected to a source of electric energy, said valve means, when energized, operatively connecting said fluid pressure-operated means to said fluid pressure source and when de-energized disconnecting said fluid pressure-operated means from said fluid pressure source.

13. In the combination of claim 12, a manually operated switch at a remote station and in the circuit between said source of electric energy and said valve means, whereby opening of said switch de-energizes said valve means.

14. In the combination of claim 13, a second switch in the circuit between said source of electric energy and said valve means, and actuating means operatively connected to said second switch, sensitive to the pressure of said fluid pressure source, and effective to open said second switch when the pressure of said fluid pressure source falls below a predetermined value.

15. In the combination of claim 12, a switch in the circuit between said source of electric energy and said valve means, and actuating means operatively connected

to said switch, sensitive to the pressure of said fluid pressure source, and effective to open said switch when the pressure of said fluid pressure source falls below a predetermined value.

16. In the combination of claim 12, a fluid pressure-operated motor operatively connected to said door to open and close the latter, said motor being connected to said fluid pressure source via an electrically energized valve means, said valve means, when energized, connecting said motor to said fluid pressure source so as to open said door, and when de-energized connecting said motor to said fluid pressure source so as to close said door, said source of electric energy being connected to said valve means via a switch, and actuating means operatively connected to said switch, sensitive to the pressure of said source, and effective to cause said switch to open, de-energizing said valve means, when the pressure of said source falls below a predetermined value.

17. In the combination of claim 16, a second manually actuated switch connected between said source of electric energy and said motor valve means and in series with said first switch, opening or closing of said second switch de-energizing or energizing said motor valve means so long as said first switch is closed.

18. In the combination of a door mounted on a wall common to adjoining compartments, a keeper assembly mounted in said wall and including a keeper element movable into cooperating position with said door to retain the door in closed position, means biasing said keeper element into said cooperating position, and fluid pressure-operated keeper control means operatively connected to said keeper element and active, when actuated, to move said keeper element out of said cooperating position, and a fluid pressure-operated closure means operatively connected to said door and effective, when appropriately actuated, to move said door between closed and open positions, both said closure means and said keeper control means being connected to a source of fluid pressure; the improvement which comprises a first electrically energized valve between said source and said closure means which, when energized, actuates said closure means to close said door, a second electrically energized valve between said source and said keeper control means which, when energized, connects said source to said means, said first valve being connected to a source of electrical energy via a first manually operable switch, and said first and second valves being connected to said source of electrical energy via a second normally operated switch.

19. In the combination of claim 18, resilient means active on said door independently of said fluid pressure operated closure means to urge said door to closed position.

20. In the combination of a door mounted on a wall common to adjoining compartments, a keeper assembly mounted in said wall and including a keeper element movable into cooperating position with said door to retain the door in closed position, means biasing said keeper element into said cooperating position, and fluid pressure-operated keeper control means operatively connected to said keeper element and active, when actuated, to move said keeper element out of said cooperating position, and a fluid pressure-operated closure means operatively connected to said door and effective, when appropriately actuated, to move said door between closed and open positions, both said closure means and said keeper control means being connected to a source of fluid pressure; the improvement which comprises a first electrically energized valve between said source and said closure means which, when energized, actuates said closure means to close said door, a second electrically energized valve between said source and said keeper control means which, when energized, connects said source to said keeper control means, said first valve being connected to a source of electrical energy via a first

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manually operable switch, and said first and second valves being connected to said source of electrical energy via a second normally operated switch, and said first and second valves being connected to said source of electrical energy via a third switch sensitive to the pressure in said fluid pressure source and active to open the electrical circuit to said first and second valves whenever said pressure falls below a predetermined value.

21. In the combination of claim 20, resilient means active on said door independently of said fluid pressure-operated closure means to urge said door to closed position.

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